STATEMENT OF WORK (SOW) FOR THE NEXT GENERATION LAND MOBILE RADIO (NGLMR) REQUEST FOR INFORMATION (RFI)

1.0 Introduction

This Statement of Work (SOW) describes the functions and requirements to be performed under contract to the National Aeronautics and Space Administration (NASA) for delivery of specified products and services related to the Land Mobile Radio (LMR) project at Goddard Space Flight Center (GSFC) in Greenbelt, MD and Wallops Flight Facility (WFF), in Wallops Island, VA.

Both centers currently operate independent M/a-Com Enhanced Digital Access Communications System (EDACS) LMR systems, which were installed in 2005 and have components that have reached the end of life (EOL). The legacy systems are currently under maintenance contracts until August 2015.

This SOW involves replacing the autonomous trunked LMR systems at the Greenbelt and Wallops facilities with an enterprise Project 25 (P25) compliant trunked system; that has scalability to integrate all other NASA centers either as part of, or subsequent to, the initial delivery; and the flexibility to integrate additional frequencies.

1.1 *Scope*

The Contractor shall provide a core system that is initially configured to provide LMR services for the GSFC Greenbelt and Wallops sites. The Contractor may propose to host the core system at a NASA Site or a Contractor facility, provided that the Contractor facility meets National Institute of Standards and Technology (NIST) and NASA Information Technology (IT) security requirements.

The Contractor shall install Radio Frequency (RF) sites at the Greenbelt and Wallops campuses, and integrate the sites with the core system over NASA provided communication links. The Contractor shall fully configure and optimize RF sites and verify that the sites are not causing any intermodulation or RF interference that could impact NASA science and research interest. The Contractor shallR assist NASA in the initial configuration of talk-groups and channels, and perform any activities required for RF sites to interoperate with external LMR systems. The Contractor shall also provide quantities of Hand-held, Desktop, and Vehicular units, and assist with the initial programming of Subscribers for comprehensive acceptance testing. The Contractor shall also install and configure Dispatch Consoles, and a voice recorder at each Site.

The Contractor shall be responsible for the monitoring, fault detection, and corrective maintenance for the core LMR system and all RF sites; subject to Service Level Agreements defined in the SOW. The Contractor shall also be responsible for preventative maintenance for the LMR system, including patches and updates to applications and Operating Systems (OS). The Contractor shall service, maintain and repair all fixed and portable LMR system equipment for the life of the contract; as well as existing coverage enhancing equipment and any additional coverage enhancing equipment provided by the Contractor to meet coverage requirements.

The Contractor shall be responsible for providing a LMR system, dispatch consoles and a quantity of hand-held and vehicular units and ancillary equipment. The Contractor shall be responsible for the shipment and delivery of the LMR equipment to either Greenbelt or Wallops.

Each site will conduct independent acceptance testing, and once system acceptance has occurred at each location, the Contractor shall provide preventative and corrective maintenance for all LMR equipment and maintain the coverage and services provided. The Contractor shall have access to replacement parts to support corrective maintenance service requirements, and allow NASA to purchase all delivered LMR components, including complete RF sites, as well as engineering services by labor category for the Term.

1.2 *Installation Locations*

At Greenbelt and Wallops, the LMR system infrastructure shall be installed at the designated infrastructure site, with related antenna being installed on the adjacent tower.

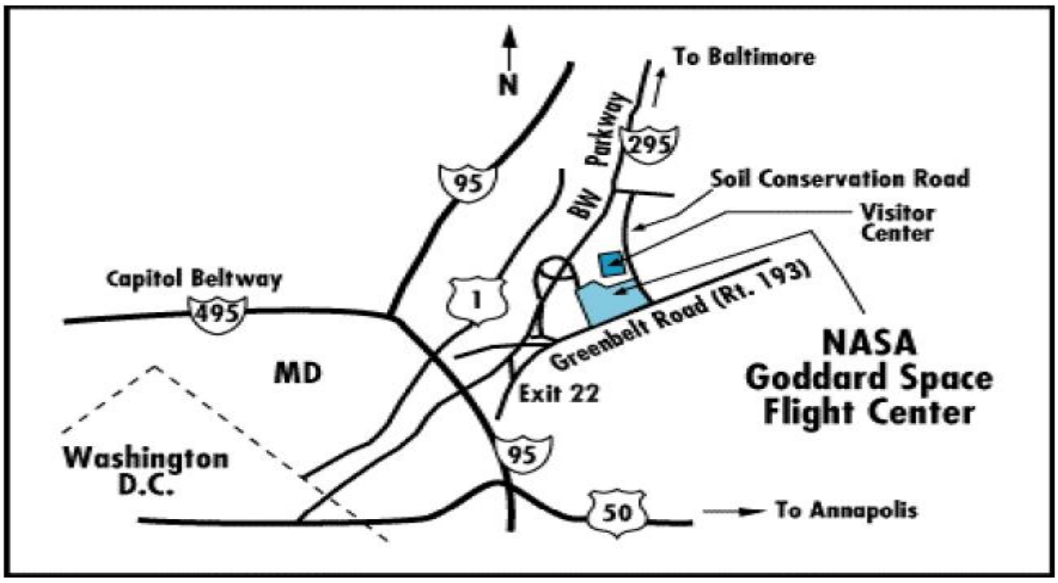

Figure 1: Goddard Space Flight Center - Greenbelt Map

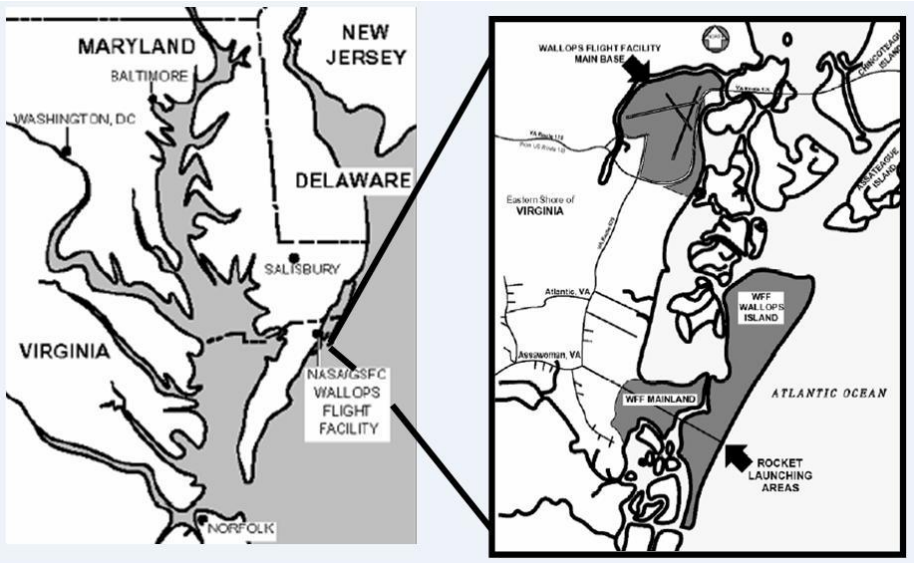

Figure 2: Wallops Flight Facility - Wallops Map

1.3 *Overview of Current Systems*

1.3.1 Greenbelt

Greenbelt currently operates one 5-channel RF site (MASTR III trunking station) that services the following Ultra High Frequency (UHF) channels.

	NARROW-BAND FREQUENCIES	
Channel	**Transit (MHz)**	**Receive (MHz)**
27	406.4375	415.4375
59	406.8375	415.8375
72	409.4500	418.4500
107	407.4375	416.4375
123	407.6375	416.6375

Table 1: UHF Channels - Greenbelt

The core system consists of an integrated multi-site controller (IMC), management server, communication system director (CSD) server, CSD workstation, three C3 maestro dispatch consoles, and an Exacom logging recorder.

To help improve coverage in critical areas, system infrastructure also includes 1 Bi-Directional Amplifier (BDA), 6 magmount antennas, 3 Bandpass filters, amplifiers and 1 splitter. Recently an additional repeater was installed at an off-site location which is adjacent to the Greenbelt campus. The Greenbelt LMR system is not connected to the Internet or any Government Furnished Equipment (GFE) network. A logical drawing is included in Figure 3 below.

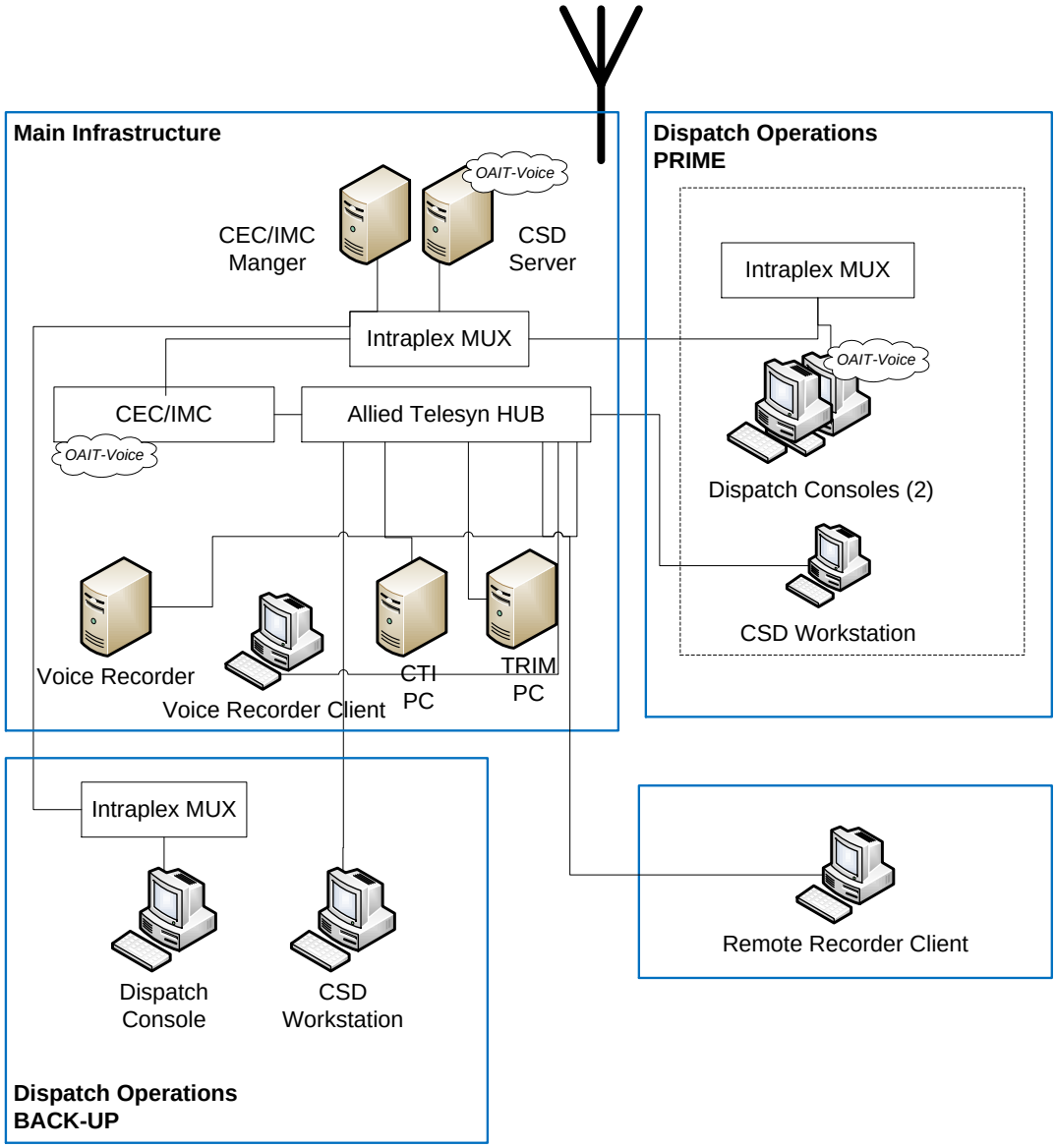

Figure 3: LMR System Architecture - Greenbelt

Greenbelt currently operates 437 handheld radios (P5130, P7150 and P7170 models), 5 desktop units and 10 mobile units.

Following is a list of the existing equipment at Greenbelt.

System Infrastructure (Main Site)		
Equipment Type	**Description**	**Quantity**
Repeater	MASTR III E-Net complete with Site Pro	5
Cabinet	83 Inches	2
	69 Inches	1
Enhanced Digital Access Communication System (EDACS)	Site Interface Module	1
	Site Sentry	1
	Site SureCall	1
	Hotline Telephone Interconnect	1
Combiner	5 CH,410-430 MHz (P/N DB4368-5-AD)	1
Multicoupler	RX,380-520 MHz,4 Port (P/N 42-57-01-04N)	1
Antenna	Fiberglass,6 dBd (P/N DB636-A)	2
CEC Switch (2 Cages)	MIM Card	1
	Audio Card	8
	CIM Card	3
	TRIM Card	1
	PIM Card	2
	VMIM Card	1
	MOM Card	1
	CCI Card	1
	CI Card	3
T-1 Multiplexer	ACS T1 MUX AC RJ45, IX-ACS-163-ACC	3
	ASYNC DATA 4PORT 38.4 KBPS, IX-DA-	3
	PORT RS232 INTERFACE, IX-MA-404	3
	4CH 4WIRE E&M VOICE, IX-VF-25	3
	4CH 4W VOICE 50 PIN TELCO E&M, IX-MA-	3
CSD Server		1
IMC Manager PC		1
T-1 Multiplexer	ACS T1 MUX AC RJ45, IX-ACS-163-ACC	1
	ASYNC DATA 4PORT 38.4 KBPS, IX-DA-	1
	PORT RS232 INTERFACE, IX-MA-404	1

Table 2: System Infrastructure Equipment List (Main Site)

Site 2 Equipment List (Dispatch Operations, PRIME)		
Equipment Type	**Description**	**Quantity**
Remote Logging Recorder	Exacom Hindsight Recorder	1
	Remote Logging Recorder Terminal	1
Dispatch Console	C3 Maestro Console	1
	Enhanced Audio Controller Module	1
	Computer with C3S Maestro Software	1
	20 Inch Touch-screen Flat-panel Monitor	1
	Rackmount Speaker Kit with B/G Microphone	1
	Footswitch (single)	1
	Gooseneck Microphone	1
	Supra Headset Prong Adapter	1
	6-wire Headset Jack-box	1
	Headset Jack Module	1
	Call Director Kit	1
	Auxiliary Input/Output Feature	1
	Integrated Stack Paging	1
	Broadcast Intercom	1
	Fire Hall Alerting	1
	Module Status	1
	User Definable Screen/SVC Pak Software	1
	2-channel Ears Point of Recording Recorder	1
T1 Multiplexor	ACS T1 MUX AC RJ45, IX-ACS-163-ACC	1
	ASYNC DATA 4PORT 38.4 KBPS, IX-DA-	1
	PORT RS232 INTERFACE, IX-MA-404	1
	4CH 4WIRE E&M VOICE, IX-VF-25	1
	4CH 4W VOICE 50 PIN TELCO E&M, IX-MA-	1
Bi-Directional Amplifier	61-65-96464	1
Remote CSD Client	Computer with CSD Software	1

Table 3: Site 2 Equipment List (Dispatch Operations)

Site 3 Equipment List (Backup Dispatch Operations)		
Equipment Type	**Description**	**Quantity**
Dispatch Console	C3 Maestro Console	2
	Enhanced Audio Controller Module	2
	Computer with C3S Maestro Software	2
	20 Inch Touch-screen Flat-panel Monitor	2
	Rackmount Speaker Kit with B/G Microphone	2
	Footswitch (single)	2
	Gooseneck Microphone	2
	Supra Headset Prong Adapter	2
	6-wire Headset Jack-box	2
	Headset Jack Module	2
	Call Director Kit	2
	Auxiliary Input/Output Feature	2
	Integrated Stack Paging	2
	Broadcast Intercom	2
	Fire Hall Alerting	2
	Module Status	2
	User Definable Screen/SVC Pak Software	2
	2-channel Ears Point of Recording Recorder	2
T1 Multiplexor	ACS T1 MUX AC RJ45, IX-ACS-163-ACC	1
	ASYNC DATA 4PORT 38.4 KBPS, IX-DA-	1
	PORT RS232 INTERFACE, IX-MA-404	1
	4CH 4WIRE E&M VOICE, IX-VF-25	2
	4CH 4W VOICE 50 PIN TELCO E&M, IX-MA-	2
Remote CSD Client	Computer with CSD Software	1

Table 4: Site 3 Equipment List (Backup Dispatch Operations)

1.3.2 Wallops

WFF is comprised of three main areas: the Island, the Mainland, and the Mainbase, as depicted in Figure 2.

Wallops currently operates one 5-channel RF site (MASTR III trunking station on the Mainbase and one 4-channel RF site on the Island that serves the following Very High Frequency (VHF) channels:

	NARROW-BAND FREQUENCIES	
Channel	**Transit (MHz)**	**Receive (MHz)**
1	162.1125	169.6125
2	164.1000	171.3875
3	165.4625	172.9625
4	165.7500	173.4250
5	166.2250	173.7250

Table 5: VHF Frequencies at Main Site

	NARROW-BAND FREQUENCIES	
Channel	**Transit (MHz)**	**Receive (MHz)**
1	163.2750	170.7625
2	165.1875	172.6875
3	165.4875	172.9875
4	166.1875	173.6875

Table 6: VHF Frequencies at Island Site

The core system consists of an integrated multi-site controller (IMC), communication system director (CSD) server, CSD workstation, three C3 maestro dispatch consoles, Nice Call Focus logging recorder, and two 5-channel (multi-site) MASTR III trunking stations. The primary equipment for the Wallops LMR System backbone is housed in the Main Infrastructure Site. Repeaters are located in 2 buildings, as well as antennas on 2 towers.

The WFF LMR system is a closed system with a mix of 100BaseT Media Converters, T1 Media Converters, and serial interfaces connecting the devices. A Cabletron ELS100-24 24 Port 100BaseT Switch connects the CSD Server and IMC Computer to the IMC Switch. A logical drawing of the WFF LMR system is provided in Figure 4 below.

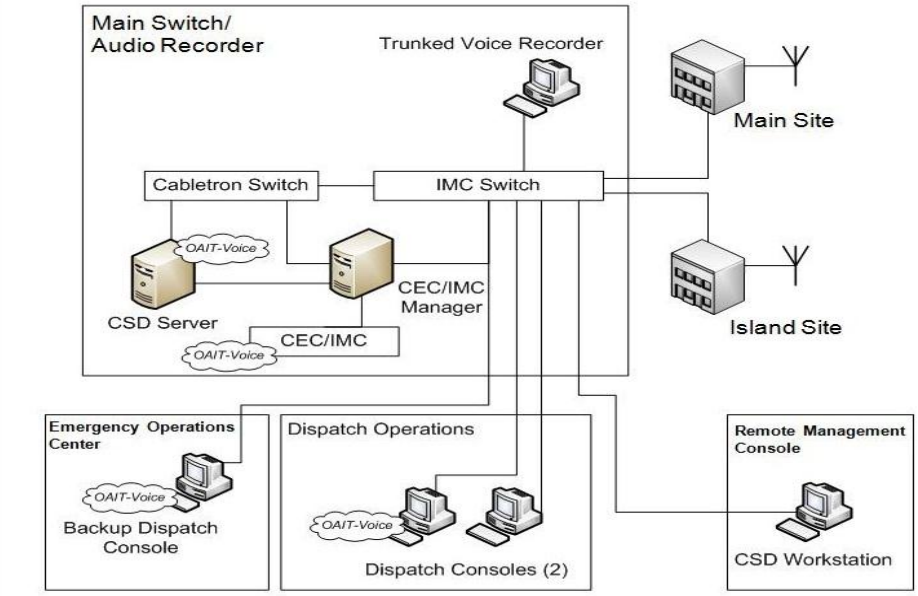

Figure 4: WFF LMR System Architecture

WFF currently operates 312 handheld radios (P5130, P7150 and P7170 models), 17 in-vehicle radios, and 6 desktop units.

Below is a list of the WFF infrastructure equipment:

Equipment Type	Model	Qty
Integrated Multi-site Controller (IMC) Computer (Win XP 5.1)	KDV1201070/36R3C	1
Communication System Director (CSD) (Win Svr 2003)	17538	1
CSD Workstation (Win XP 5.1)	DHM	1
Dispatch Console (Win XP 5.1)	2C-KDC-1201069/103R6B	1
Dispatch Console (Win XP 5.1)	2C-KDC-1201069/103R6B	1
Dispatch Console (Win XP 5.1)	2C-KDC-1201069/103R6B	1
Nice Call Focus Logging Recorder	506C0227-03	1
Centralized Telephone Interconnect (CTI) Workstation	Not Activated	1
Logging Recorder Interface Manager (LRIM) Workstation (Win NT)	T70284	1
T1 Modem F-2 to F-166	TC1630S-01-ST-1-12	1
T1 Modem F-166	TC1630S-01-ST-1-12	1
T1 Modem F-2 to X-75 (second site)	TC1630S-L1-1-12	1
T1 Modem X-75 (second site)	TC1630S-L1-1-12	1
Ethernet Media Converter	10/100 MC Basic	1

Table 7: WFF infrastructure - Equipment List

1.4 *Safety and Health Program Compliance*

The Contractor shall comply with its Safety and Health Plan as approved by NASA. This compliance shall include standards, plans, and reporting procedures identified in the plan concerning safety and health. The LMR equipment shall be installed and tested in accordance with NASA standards 29 Code of Federal Regulations (CFR) 1910, Occupational Safety and Health Standards; 29 CFR 1926, Safety and Health Regulations for Construction; NASA Procedural Requirements (NPR) 8715.3 NASA Safety Manual or with equivalent industry standards including FCC, Underwriters Laboratories (UL), and Network Equipment Building System (NEBS) standards for safety.

1.5 *Schedule Management*

NASA expects to fund this acquisiton as early as Fiscal Year (FY) 2016, however, since the exact date is unknown, the Contractor's schedule should include all milestones required to complete the project, with dependencies and durations for each activity.

2.0 System Requirements

All Contractor deliverables and activities resulting from requirements defined in Section 2 are included in the firm fixed price (FFP) of the contract. The requirements in Sections 2 through 4 pertain to both the Greenbelt and WFF systems unless otherwise stated.

2.1 *Centralized Core System*

2.1.1 The Contractor shall install a Project 25 (P25) compliant Core LMR system to support approximately 450 subscribers at Greenbelt and 300 subscribers at Wallops, which is scalable to support a minimum of 10 NASA sites with an aggregate of 7300 subscribers.

2.1.2 The Contractor may propose to host the core at either the Greenbelt site or a secure Contractor facility. If a secure Contractor facility is proposed, the Contractor shall describe the security profile of the proposed facility in sufficient detail to assess compliance with NIST and NASA IT Security requirements, and indicate whether the hosting facility is Fedramp (http://www.gsa.gov/portal/category/102371) certified.

2.1.3 The System shall be highly reliable with fault tolerant design options. The primary components such as the Network Switch, servers, gateways, repeaters, network interface and critical infrastructure shall be redundant, fault tolerant and provide for automatic failover to the online spare.

2.1.4 The Contractor shall detail the capacity of the core system, including the number of Subscribers, talk-groups, RF sites, external interfaces, gateways, and consoles that are supported.

2.1.5 The System shall allow Talk-groups to be shared between any and all Sites that share the common Core, including sites that are later added through Indefinite Delivery Indefinite Quantity (IDIQ) purchase.

2.1.6 The system shall support security partitioning and role base assignment of system administrative functions and associated user rights. The system shall enable designated system administrators (or designee), by NASA Center, the ability to grant end users administrative privileges. For shared systems the bidder is to provide granular levels of user security and enhanced agency partitioning. The Contractor shall assist NASA in the configuration of user accounts and permissions for all Sites.

2.1.7 The Contractor shall describe the methods by which the Government accesses the LMR system, the functions that can be performed through each method, and indicate how the system restricts access so that users can only view information and affect changes for their Site.

2.1.8 The System shall be configured to allow trunking to be maintained at the RF site in the event that the centralized radio switch is unavailable. The Contractor shall describe capabilities that are lost in the event that the

centralized radio switch is unavailable (e.g. dispatch, configuration, management).

2.1.9 The System shall support Wide Area Trunking, roaming, seamless handoff when roaming. The system shall support Linear (CQPSK) Simulcast to the subscriber fleet which the Contractor shall describe in detail. The Contractor shall describe how Linear Simulcast can interoperate with C4FM P25 systems. The Contractor shall describe the Simulcast approach for P25 Phase 2 including the site antenna system.

2.2 *Open Architecture*

2.2.1 All LMR equipment technology shall use an open architecture, or NASA approved equal, so that NASA may select future equipment from Contractor-licensed third-party manufacturers.

2.2.2 The Contractor shall identify any and all differences in operating and managing third party equipment (e.g. subscribers, dispatch equipment, repeaters, interface equipment) and the effect on features and functionality (e.g. Over the Air Rekeying (OTAR), Over the Air Programming (OTAP), Information Assurance (IA)).

2.2.3 The System shall rely on Commercial-Off-the-Shelf (COTS) hardware and software. The Contractor shall provide details where the system requires proprietary system and subsystem hardware and software components.

2.2.4 All LMR equipment shall meet requirements of National Telecommunications and Information Administration (NTIA) Rules and Regulations for Radio Equipment, Chapter 5, of the latest version.

2.2.5 The LMR System shall meet current FCC requirements and those currently proposed. In the event of conflicts between the FCC and NTIA requirements, the more stringent requirement shall apply.

2.3 *Facilities and Power*

2.3.1 The Contractor shall provide power specifications for each device that requires Government Furnished Equipment (GFE) power. The Contractor shall also provide lightning protection on all lines, including control lines, communication lines (voice and data), telephone lines, AC power lines, and all RF transmission lines. The Contractor shall ensure that all equipment is properly grounded by attachment to building and/or tower grounding system as applicable, and in accordance with the latest revision of the National Electrical Code (NEC).

2.3.2 The Contractor shall provide all details related to space, power and grounding requirements and standards. The Contractor shall provide cost

associated with any and all site improvements required as part of their bid and system warranty.

2.4 *Performance*

2.4.1 The Contractor shall provide switch and Subscriber latency specifications that they will guarantee.

2.4.2 The Contractor shall provide data on Subscriber and system components Mean-Time-Between-Failures (MTBF) and Mean-Time-To-Restore (MTTR).

2.4.3 The Contractor shall identify any methods that are in place to identify when a radio needs to be retuned, or when the radios operating characteristics do not fall within the required parameters; and describe the method to remediate radios to operate at the required parameters.

2.5 *LMR Features*

2.5.1 The System shall support integrated voice and data.

2.5.2 The delivered System shall support and accommodate text messaging to and from Dispatch Consoles and Subscriber units.

2.5.3 The System shall support Global Position System (GPS) on portable, mobile and other devices.

2.5.4 The System shall support a centralized and distributed OTAR configuration. This will allow for local (centralized switch) and remote (RF site, consoles) re-keying of subscribers.

2.5.5 The System shall support OTAP to P25 subscribers (mobiles, portables, fixed), dispatch, site equipment and infrastructure as required to allow remote updates to device configurations, software updates as well as IAecurity updates and patches.

2.6 *Recording*

2.6.1 The System shall support voice recording and logging of all talk-groups. The system shall support remote access to the recording system for retrieval of authorized voice activity over an Internet Protocol (IP) connection.

2.6.2 The Contractor shall provide a digital recorder at both Greenbelt and Wallops and configure the recorder to record all talk-groups.

2.7 *External Interfaces*

2.7.1 The System shall support an ISSI interface to other P25 trunked networks including other Contractor P25 systems.

2.7.2 The System shall support a secure interface to conventional P25 radio systems.

2.7.3 The System shall support a secure interface to Long Term Evolution (LTE) and other Cellular networks as well as data networks. The Contractor shall describe which components (e.g. subscribers, dispatch consoles), if any, that can be performed by a software application on a GFE device (e.g. mobile phone, NASA workstation), and describe any difference in capability when operating under this model.

2.7.4 The System shall provide an interoperability gateway to interface with local and remote legacy systems and local and remote NASA intercom systems. The conventional channel(s) shall be assigned individual Talk-Group ID's on the system.

2.7.5 The Contractor shall work with the NASA Integrated Communications Services (NICS) contractor to integrate the LMR system and the Cisco IP telephony system at the Greenbelt Site. The telephony interface shall allow users to make and receive voice calls to and from the P25 system. The system shall support a minimum of 10 simultaneous calls with future expansion capability. Priority levels for telephone calls shall be programmable at the system level so that individual users can be given priority.

2.8 *Greenbelt RF Site*

2.8.1 The Contractor shall install one 5 Channel RF sites at Greenbelt using the available frequencies in Table 7 below, operating in a two-slot time division multiple access (TDMA) standard for 12 KHz radio channels:

CHANNEL	TRANSMIT MHz	RECEIVE MHz	SPACING
11	406.2375	415.2375	12.5 kHz
27	406.4375	415.4375	12.5 kHz
59	406.8375	415.8375	12.5 kHz
75	407.0375	416.0375	12.5 kHz
91	407.2375	416.2375	12.5 kHz
107	407.4375	416.4375	12.5 kHz
123	407.6375	416.6375	12.5 kHz

Table 8: GSFC UHF Frequencies

2.8.2 The Contractor shall include the cost to purchase and install a replacement antenna if the existing antenna at Greenbelt is not sufficient.

2.8.3 The Contractor shall install and configure two Dispatch Consoles, one being a Prime and the second a Back-up. The Prime location is manned 24x7x365. The Prime and Back-Up locations shall be able to provide all LMR services.

2.9 *Wallops RF Site*

2.9.1 The Contractor shall install two 6 Channel RF sites at Wallops using the available frequencies in Table 8 below, operating in a two-slot time division multiple access (TDMA) standard for 12 KHz radio channels:

CHANNEL	TRANSMIT MHz	RECEIVE MHz	SPACING
11	406.2375	415.2375	12.5 kHz
27	406.4375	415.4375	12.5 kHz
59	406.8375	415.8375	12.5 kHz
75	407.0375	416.0375	12.5 kHz
91	407.2375	416.2375	12.5 kHz
107	407.4375	416.4375	12.5 kHz
123	407.6375	416.6375	12.5 kHz

Table 9: WFF UHF Frequencies

2.9.2 The Wallops sites shall be configured to operate in Simulcast mode.

2.9.3 The Contractor shall install GPS receivers and verify synchronous timing between the Wallops RF sites.

2.9.4 The Contractor shall include the cost to purchase and install 4 replacement antennas.

2.9.5 The Contractor shall install and configure three Dispatch Consoles, two in the Dispatch Center and one in the Emergency Operations Center (EOC).

2.10 *Greenbelt Coverage Requirements*

2.10.1 The Greenbelt System shall provide 95% coverage, 95% of the time to portable radios operating at head level (talk-in) and hip level (talk-out) for all areas within the Site's perimeter. This two-way communication shall be maintained whether using hand-held, vehicle unit, or base station at any location above and below ground (i.e. underground tunnels and manholes).

2.10.2 The Greenbelt System shall provide 95% coverage, 95% of the time for the following off-site areas that are within a 7 mile radius of Greenbelt.

- Cherrywood Lane/Greenbelt Metro Drive (Greenbelt Metro Station) (4 Miles)
- Visitor's Center (borders perimeter)
- Powder Mill Road/Baltimore Washington Parkway (1 Mile)
- Riverdale Road/Baltimore Washington Parkway (3 Miles)
- 85th Avenue/Harkins Road (New Carrollton Metro Station)
- 10200 Greenbelt Road, Lanham, MD (Aerospace Building) (1.5 Miles)
- Laurel-Bowie Road/Baltimore Washington Parkway (5 Miles)
- Powder Mill Road/Edmonston Road (beginning of USDA Farms) (4 Miles)
- Cherry Lane, Laurel, MD
- University of MD, College Park, MD
- Martin Luther King Jr. Highway & US Highway 50
- Martin Luther King Jr. Highway & Forbes Boulevard

2.11 *Wallops Coverage Requirements*

2.11.1 The Wallops System shall provide 95% coverage, 95% of the time to portable radios operating at head level (talk-in) and hip level (talk-out) for all areas within the Site's perimeters and in transit between the Mainbase, Mainland and Island. This two-way communication shall be maintained whether using hand-held, vehicle unit, or base station at any location above and below ground (i.e. underground tunnels and manholes).

2.12 *Security Requirements*

2.12.1 The Contractor shall comply with all appropriate NASA Security policies, including but not limited to the current version of the NASA Procedural Requirement (NPR) 2810.1A, Security of Information Technology.

2.12.2 The Contractor shall comply with NASA Procurement Notice 04-57 http://www.hq.nasa.gov/office/procurement/regs/pn04-57.html

2.12.3 The Contractor shall comply with the latest version of the NIST Special Publication 800-53 Recommended Security Controls for Federal Information Systems and Organizations for a moderate system.

2.12.4 The Contractor shall comply with the continuous monitoring of the system security posture as well as activities surrounding the routing testing of security related controls.

2.12.5 The Contractor shall fully support the Center and Agency Vulnerability Management program by performing or participating in such functions as the vulnerability scanning process while ensuring that there is no operational impact to the LMR system.

2.12.6 The Contractor shall review results of GFE vulnerability scanning against the operational system, assess the impact of applying recommended configuration or Operating System (OS) updates, and apply updates that are expected to improve the confidentiality, integrity, or availability of the system without adversely affecting performance. The Contractor shall provide NASA a justification for not installing recommended updates and develop a Plan of Action and Milestone (POAM) for each vulnerability that cannot be mitigated.

2.12.7 The Contractor shall comply with NASA requirements for malicious code protection.

2.12.8 The Contractor shall comply with NASA requirements for patch management.

2.12.9 The Contractor shall validate System compliance of Center for Internet Security (CIS) Benchmarks.

2.12.10 The Contractor shall provide documentation that demonstrates that any remote connections for management, monitoring, and troubleshooting are compliant with NASA security policy.

2.12.11 The System design shall be IP based and support end-to-end encryption between all system components. The Contractor shall provide details on all encryption standards that are supported, and the associated cost of any additional infrastructure required to support encryption.

2.12.12 The System shall meet NIST and other NASA Security requirements and standards to insure end to end user confidentiality. This requirement shall extend to the subscriber, dispatch and RF site equipment, both local and remote. The Contractor shall describe their security posture.

2.12.13 The System shall allow for secure access from the Contractor's Network Operations Center (NOC) facility. The Contractor's NOC shall be federally certified.

2.12.14 The Contractor shall provide options for 24x7x365 NOC, IA, Security Updates and local support services for maintenance of infrastructure as required.

2.12.15 The System shall allow for local and remote IA security updates and patches while continuing to provide wide area LMR service to Subscribers and Dispatch Consoles.

2.12.16 The System shall support FIPS 140-2 Compliance.

3.0 Operations and Maintenance Requirements

All Contractor maintenance activities resulting from requirements defined in Section 3 are included in the FFP of the contract; with all hardware, software, and labor costs borne by the contractor. The requirements in Section 3 pertain to both the Greenbelt and WFF systems unless otherwise stated.

3.1 *Operations*

3.1.1 The availability of the LMR system to perform its intended function shall be a minimum of 99.995 percent within a consecutive period.

3.1.2 The Contractor shall provide monitoring and fault detection on a 24x7 basis, 365 days per year; and immediately log a trouble ticket when failures are identified.

3.1.3 The System shall monitor the health and performance of the system by collecting and providing alarming and alert functions Simple Network Management Protocol (SNMP) from all sources in the network to a consolidated location.

3.1.4 The System shall maintain activity data, configuration settings, alarms and alerts for system network devices, both local and remote.

3.1.5 The Government shall be provided access to the monitoring and fault detection system.

3.1.6 All Subscribers shall be initially programmed by the Contractor in their operational configuration for acceptance testing. The Contractor shall install and configure OTAP, to ensure that NASA has the ability to program radios wirelessly or directly connected to a Contractor provided programming interface.

3.2 *Preventative Maintenance*

3.2.1 The LMR system shall include all documentations necessary to operate and maintain the system, including recommended Preventive Maintenance (PM) actions.

3.2.2 The Contractor shall be responsible for providing Warranties, Software Licenses, Spares and Parts Repair, Basic and optional Extended Maintenance Programs, Training, Documentation, and System Support.

3.2.3 The PM Program shall verify proper operation of all equipment to include repairs needed to bring equipment up to full performance standards. The PM shall include cleaning, lubrication and mechanical adjustment, as well as all required electronic alignment necessary to maintain proper

equipment operation. All work shall be in accordance with the manufacturer's recommended preventive maintenance procedures.

3.2.4 The Contractor shall notify NASA within 2 months after LMR application software updates are available, including but not limited to patches or product enhancements available through the Software maintenance program; identifying the nature of the update and any enhancements or new features contained within the update. The Contractor shall install such updates on fielded LMR components within 2 months after receiving written approval from NASA, and train NASA when new features are available.

3.2.5 The Contractor shall use installed application software to perform an audit of system components and software revision levels, and provide the audit report to NASA in electronic form within 2 weeks following the installation of software updates or any material changes to the LMR system.

3.3 *Corrective Maintenance*

3.3.1 If potential system problems cannot be fixed remotely, the Contractor shall arrive on-site at Greenbelt or Wallops to address the failure of LMR infrastructure and coverage enhancing equipment within 2 hours of outage notification, inclusive of travel time, on a 24x7 basis, 365 days per year. If unable to meet the 2-hour criteria, the Contractor shall notify the site personnel as soon as possible.

3.3.2 The Contractor shall restore failed services within 4 hours of arriving on-site at Greenbelt or WFF, on a 24x7 basis, 365 days per year. The Contractor shall ensure that replacements parts for all infrastructure equipment are readily available in order to meet the 4-hour criteria for return to service.

3.3.3 The Contractor shall repair all non-working hand-held and desktop radios and restore to original working condition within 4 weeks after receiving the defective unit. The Contractor is not expected to repair lapel microphones, antennas, chargers, holsters, or any other radio accessories.

3.3.4 All LMR equipment and software, including core equipment, RF site equipment, coverage enhancing equipment, fixed network equipment and ancillary equipment required for switching and audio distribution shall receive full remedial maintenance coverage and warranty for the Term for failures that occur due to normal operational usage.

3.3.5 The Contractor shall perform remedial maintenance service on failed infrastructure components in accordance with manufacturer's recommended maintenance procedures.

3.3.6 The Contractor shall use original equipment replacement items when performing remedial maintenance. In the event that original parts are not available, the Contractor may substitute parts of equivalent form and function that have been certified for use by relevant regulatory authorities.

3.3.7 The Contractor shall immediately report site network and cable plant issues to the Government, so that the affected site can take appropriate action.

4.0 Project Management Requirements

All Contractor project management activities resulting from requirements defined in Section 4 are included in the FFP of the contract; with all hardware, software, and labor costs borne by the contractor. The requirements in Section 4 pertain to both the Greenbelt and WFF systems unless otherwise stated.

4.1 *Training*

4.1.1 The Contractor shall develop and provide operations, maintenance, and user training to NASA designated personnel. The Contractor shall provide separate training sessions for the following three (3) courses after installation is completed:

- Maintenance Training Course – LMR equipment (LMR infrastructure, antennas, consoles, workstations, network management etc.) maintenance training including troubleshooting techniques.
- Radio Operations Training Course – Radio (both handheld and vehicle mounted) equipment operations training including configuration, reconfiguration, control, statusing, and system administration functions.
- User Radio Operations Training Course – Radio specific operations training including general operations, configuration, and reconfiguration functions.

Training shall be conducted at both Greenbelt and Wallops. The courses shall be scheduled a minimum of 2 weeks in advance by the Contractor to be held on consecutive days and shall be based on a training schedule approved by NASA. Documentation for 20 attendees for each course shall be provided. The Contractor shall provide all the necessary equipment required for each of the training sessions. This may include, but is not limited to: test data driver/simulator, LMR elements, connectivity hardware (cables, etc.) and any associated training documentation. The Contractor shall be responsible for shipping the necessary equipment to each LMR site in advance of the training and coordinate with NASA as required.

4.1.2 The Contractor shall provide on-site user training for the voice recorder system at both the Greenbelt and Wallops sites for designated personnel.

4.2 *Acceptance Testing*

4.2.1 The Contractor shall guarantee the in-building and out-of-building portable coverage in accordance with a test plan developed by the Contractor and approved by NASA.

4.2.2 The Contractor shall perform requirements verification testing for the LMR System configuration to be delivered under this contract. This testing shall verify compliance of the hardware and software to all requirements within this document.

4.2.3 Acceptance testing shall include comprehensive coverage testing for the locations specified in Section 2.11, including a verification for in-building coverage for all buildings at Greenbelt and Wallops.

4.2.4 The Contractor shall develop a Site Acceptance Test (SAT) plan that includes step-by-step procedures and a Requirement Verification Matrix (RVM) to delineate traceability of each specific requirement of the LMR SOW. The RVM shall, at a minimum, include SOW requirements references, and identification of the test procedure section and/or verification step. Testing shall include evaluations of spurious and harmonic emissions, and intermodulation. The SAT procedures shall be approved by NASA. SAT testing shall be performed by the Contractor with NASA and its contractors support at the LMR implementation site. System testing and troubleshooting shall be completed prior to site acceptance.

4.2.5 After the final delivery of all LMR products, the Contractor shall continue to provide development/delivery services until completion of Final Acceptance by NASA. This support shall include, but shall not be limited to, the following:

- Providing a primary point of contact for NASA to the Contractor
- Providing status reports as required by NASA
- Resolving any open hardware and/or software discrepancies during testing (SAT)
- Support under the warranty and maintenance plans for equipment purchased on this contract

Final Acceptance of the LMR System is considered complete when all deliverable products have been successfully tested, shipped, received, inspected, all open issues/discrepancies resolved and the LMR System has been fully operational for a minimum of 14 contiguous days. At such

time, the Contractor shall provide a letter of Final Acceptance which must be approved by NASA.

4.3 *Configuration Management*

4.3.1 The Contractor shall provide software licenses for each element of the LMR deliverables, as applicable, purchased in this contract. These agreements shall license all deliverable software separately and cover all LMR Systems purchased under the contract on a site-by-site basis. Each agreement shall be provided as a "one-time fee" license and commence with the Final Acceptance of the LMR System for each NASA site.

4.3.2 The Contractor shall provide standard hardware and software warranties for each delivered item of equipment for the Term. The warranty period shall commence after successful Final Acceptance at both Sites.

4.4 *Status Reviews*

4.4.1 At a minimum, the Contractor shall support weekly status reviews with the NASA LMR project team via telecon, email, and/or in person as required. The status reviews shall start after contract award and continue until the final acceptance of all LMR equipment. Subsequent status reviews during the maintenance support time frame shall be conducted on a monthy basis, or as-needed, with quarterly presentations to Directorate management expected. The status reviews shall address project risks and containment plans, progress against the established schedule, courses of action to correct schedule departures and problems, and near-term project plans. The first project status review shall be conducted within four (4) weeks after the contract is awarded.

4.4.2 After the final delivery of all LMR products, the Contractor shall continue to provide development/delivery services until completion of Final Acceptance by NASA. This support shall include, but shall not be limited to, the following:

- Providing a primary point of contact for NASA to the Contractor
- Providing status reports as required by NASA
- Resolving any open hardware and/or software discrepancies during testing (SAT)
- Support under the warranty and maintenance plans for equipment purchased on this contract
- Final Acceptance of the LMR System is considered complete when all deliverable products have been successfully tested, shipped, received, inspected, all open issues/discrepancies resolved and the

LMR System has been fully operational for a minimum of 14 contiguous days. At such time, the Contractor shall provide a letter of Final Acceptance which must be approved by NASA.

4.4.3 The Contractor is expected to produce any and all project management documentation and deliverables required by the NASA/GSFC Code 760 Configuration Control Board (CCB) or other NASA LMR stakeholders (e.g. Facilities Management Division, Health & Safety); which may include, but shall not be limited to, preliminary and critical design reviews, design document, operations concept and work instructions.

4.4.4 The Contractor shall present contract status to NASA management on a quarterly basis.

5.0 Supplementary Parts and Services

5.1 *Supplementary Parts*

5.1.1 The Contractor shall provide NASA the ability to purchase all hardware and software that were delivered under contract for the Term on an IDIQ basis. The Contractor shall populate the IDIQ table in Appendix B with all hardware and software items available for purchase and the associated price for each contract year. The Contractor shall also include any licensed items (e.g. Encryption, Mobile Data) that were not included in the delivery.

5.1.2 The Contractor should consider populating the IDIQ table in Appendix B with an all-inclusive price of a 3-channel, 4-channel, 5 channel, 6-channel, and 7-channel RF site. The price should include any additional tax, licensing, or warranty costs; and should be itemized and priced accordingly if RF characteristics (e.g. UHF/VHF, Simulcast) impact pricing. NASA's intent for this IDIQ requirement is to facilitate the integration of other NASA Sites to a shared core, by pricing the appropriately sized RF site and all other LMR components as IDIQ items.

5.1.3 The system shall support full featured as well as limited IP based, touch screen dispatch console equipment. The Contractor shall present and offer the full complement of dispatch console offerings and options.

5.1.4 The Contractor shall provide options and associated cost for extended warranty on all subscriber and system components.

5.2 *Supplementary Services*

5.2.1 The Contractor shall populate the IDIQ table in Appendix B with labor prices by contract year for each labor category. The Contractor shall include all labor categories that NASA may need to integrate other NASA sites through an IDIQ purchase, and for existing sites to augment, enhance, or modify their configuration.

5.2.2 The Contractor should consider populating the IDIQ table in Appendix B with the all-inclusive labor cost to integrate the following items: RF site (by channel), recorder, dispatch console, and antenna. NASA's intent is to facilitate the integration of other NASA sites to a shared core, by including the relevant labor costs as IDIQ items.

Appendix A. Acronyms

Acronym	Definition
BDA	Bi-directional amplifier
CCB	Configuration Control Board
CFR	Code of Federal Regulations
CIS	Center for Internet Security
COTS	Commercial-Off-the-Shelf
COR	Contracting Officer Representative
CSD	Communication System Director
EDACS	Enhanced Digital Access Communication System
EOC	Emergency Operations Center
EOL	End of Life
FCC	Federal Communications Commission
FFP	Firm Fixed Price
FY	Fiscal Year
GFE	Government Furnished Equipment
GPS	Global Positioning System
GSFC	Goddard Space Flight Center
IA	Information Assurance
IDIQ	Indefinite Delivery Indefinite Quantity
IMC	Integrated Multi-site Controller
IP	Internet Protocol
IT	Information Technology
LMR	Land Mobile Radio
LTE	Long Term Evolution
MTBF	Mean-Time-Between-Failures
MTTR	Mean-Time-To-Restore
NASA	National Aeronautics and Space Administration
NEBS	Network Equipment Building System
NEC	National Electrical Code
NGLMR	Next Generation Land Mobile Radio
NICS	NASA Integrated Communications Services
NIST	National Institute of Standards and Technology
NOC	Network Operations Center
NPR	NASA Procedural Requirements
NTIA	National Telecommunications and Information Administration
O&M	Operations and Maintenance
OS	Operating System
OTAP	Over the Air Programming
OTAR	Over the Air Rekeying
P25	Project 25

Acronym	Definition
POAM	Plan of Action and Milestone
PM	Preventative Maintenance
RF	Radio Frequency
RFI	Request for Information
SAT	Site Acceptance Test
SNMP	Simple Network Management Protocol
SOW	Statement of Work
TDMA	Time Division Multiple Access
UHF	Ultra High Frequency
UL	Underwriters Laboratories
VHF	Very High Frequency
WAN	Wide Area Network
WFF	Wallops Flight Facility

Appendix B. IDIQ Price List

Indefinite Delivery/Indefinite Quantity (ID/IQ) Price List														
Item #	**Vendor Part #**			**Unit**	**CY 1 Price**	**CY 2 Price**	**CY 3 Price**	**CY 4 Price**	**CY 5 Price**	**CY 6 Price**	**CY 7 Price**	**CY 8 Price**	**CY 9 Price**	**CY 10 Price**
A		**CORE COMPONENTS**												
A.1		Core Switch/Servers (Site Hosted)												
A.1.a		Hardware Element	1	Each										
A.1.b		Maintenance for Hardware Element	1	Year										
A.2		Core Switch/Servers (Vendor Hosted)												
A.2.a		Hardware Element	1	Each										
A.2.b		Maintenance for Hardware Element	1	Year										
A.3		Redundant Core Switch/Servers (Site Hosted)												
A.3.a		Hardware Element	1	Each										
A.3.b		Maintenance for Hardware Element	1	Year										
A.4		Redundant Core Switch/Servers (Vendor Hosted)												
A.4.a		Hardware Element	1	Each										
A.4.b		Maintenance for Hardware Element	1	Year										
A.5		Network Equipment												
A.5.a		Hardware Element	1	Each										
A.5.b		Maintenance for Hardware Element	1	Year										
B		**RF SITE COMPONENTS**												
B.1		UHF Antenna												
B.1.a		Hardware Element	1	Each										
B.1.b		Maintenance for Hardware Element	1	Year										
B.2		VHF Antenna												
B.2.a		Hardware Element	1	Each										
B.2.b		Maintenance for Hardware Element	1	Year										
B.3		Repeater/Controller												
B.3.a		Hardware Element	1	Each										

Indefinite Delivery/Indefinite Quantity (ID/IQ) Price List															
Item #	**Vendor Part #**			**Unit**	**CY 1 Price**	**CY 2 Price**	**CY 3 Price**	**CY 4 Price**	**CY 5 Price**	**CY 6 Price**	**CY 7 Price**	**CY 8 Price**	**CY 9 Price**	**CY 10 Price**
B.3.b		Maintenance for Hardware Element	1	Year										
B.4		Combiner												
B.4.a		Hardware Element	1	Each										
B.4.b		Maintenance for Hardware Element	1	Year										
B.5		GPS Locator												
B.5.a		Hardware Element	1	Each										
B.5.b		Maintenance for Hardware Element	1	Year										
B.6		Intra-System Cabling & Connectors												
B.6.a		Hardware Element	1	Each										
B.6.b		Maintenance for Hardware Element	1	Year										
C		**ANCILLARY EQUIPMENT**		**Each**										
C.1		Digital Recorder												
C.1.a		Hardware Element	1	Each										
C.1.b		Maintenance for Hardware Element	1	Year										
C.2		Encryption Hardware & Software												
C.2.a		Hardware Element	1	Each										
C.2.b		Maintenance for Hardware Element	1	Year										
C.3		Programming Station & Cabling												
C.3.a		Hardware Element	1	Each										
C.3.b		Maintenance for Hardware Element	1	Year										
C.4		Dispatch Console												
C.4.a		Hardware Element	1	Each										
C.4.b		Maintenance for Hardware Element	1	Year										
D		**COMPLETE RF SITE INTEGRATION**												
D.1		3 Channel RF Site												
D.1.a		Hardware Element	1	Each										
D.1.b		Maintenance	1	Year										
D.1.c		System Integration	1	Each										
D.2		4 Channel RF Site												
D.2.a		Hardware Element	1	Each										
D.2.b		Maintenance	1	Year										

Indefinite Delivery/Indefinite Quantity (ID/IQ) Price List															
Item #	**Vendor Part #**			**Unit**	**CY 1 Price**	**CY 2 Price**	**CY 3 Price**	**CY 4 Price**	**CY 5 Price**	**CY 6 Price**	**CY 7 Price**	**CY 8 Price**	**CY 9 Price**	**CY 10 Price**
D.2.c		System Integration	1	Each										
D.3		5 Channel RF Site												
D.3.a		Hardware Element	1	Each										
D.3.b		Maintenance	1	Year										
D.3.c		System Integration	1	Each										
D.4		6 Channel RF Site												
D.4.a		Hardware Element	1	Each										
D.4.b		Maintenance	1	Year										
D.4.c		System Integration	1	Each										
D.5		7 Channel RF Site												
D.5.a		Hardware Element	1	Each										
D.5.b		Maintenance	1	Year										
D.5.c		System Integration	1	Each										
E		**SUBSCRIBERS**												
E.1		Subscriber Unit #1												
E.1.a		Hardware Element	1	Each										
E.1.b		Maintenance for Hardware Element	1	Year										
E.2		Vehicle Mounted Unit												
E.2.a		Hardware Element	1	Each										
E.2.b		Maintenance for Hardware Element	1	Year										
E.3		Desktop/Basestation Unit												
E.3.a		Hardware Element	1	Each										
E.3.b		Maintenance for Hardware Element	1	Year										
		Software Based Subscriber (LTE)												
E.3.a		Hardware Element	1	Each										
E.3.b		Maintenance for Hardware Element	1	Year										
F		**MISCELLANEOUS EQUIPMENT**												
F.1		Lapel Microphones	1	Each										
F.2		Earwigs	1	Each										
F.3		Batteries	1	Each										
F.4		Chargers (Single)	1	Each										

Indefinite Delivery/Indefinite Quantity (ID/IQ) Price List														
Item #	**Vendor Part #**			**Unit**	**CY 1 Price**	**CY 2 Price**	**CY 3 Price**	**CY 4 Price**	**CY 5 Price**	**CY 6 Price**	**CY 7 Price**	**CY 8 Price**	**CY 9 Price**	**CY 10 Price**
F.5		Chargers (Gang)	1	Each										
F.6		Leather Holsters	1	Each										
F.7		Antenna	1	Each										
F.8		Belt Clips	1	Each										
G		**ADDITIONAL TRAINING**												
G.1		Maintenance Training Session	1	Each										
G.2		Operations Training Session	1	Each										
G.3		LMR User Training Session	1	Each										
H		**ENGINEERING SERVICES**												
H.1		Skill Category #1 – Sr engineer	1	Hour										
H.2		Skill Category #2 – Jr Engineer	1	Hour										
H.3		Skill Categoty #3 - Field Engineer	1	Hour										
H.4		Skill Category #4 – Software engineer	1	Hour										

NOTE 1: The Contractor shall populate and expand Sections A through H in above table to include all available hardware and software components. Additional CLINs that are added by the Contractor shall follow the above numbering convention.

NOTE 2: Training classes in Section G in above table are to conducted pursuant to requirements in Section 4.0 of the SOW.

NOTE 3: The Contractor shall populate and expand Section H in above table to include all labor categories that are available for engineering services. Additional CLINs that are added by the Contractor shall follow the above numbering convention.